

8 APR 2000

Sertifikaat

REPUBLIEK VAN SUID-AFRIKA

Certificate

PATENTKANTOOR

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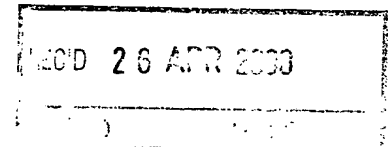
PATENT OFFICE

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REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF TRADE
AND INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that



**PRIORITY
DOCUMENT**
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)

- 1) South African Patent Application No. 99/1479 accompanied by a Provisional Specification was filed at the South African Patent Office on the 24 February 1999, in the name of Potchefstroom University for Christian Higher Education in respect of an invention entitled: "Method and apparatus for producing ozone".
- 2) The photocopy attached hereto is a true copy of the provisional specification and drawings filed with South African Patent Application No. 99/1479.

BIA in die Republiek van Suid-Afrika, hierdie 22nd dag van
in the Republic of South Africa, this day of

March 2000

[Signature]
Registrateur van Patente
Registrar of Patents

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT

(Section 30 (1) - Regulation 22)

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate.

PATENT APPLICATION NO.		
21	01	991479

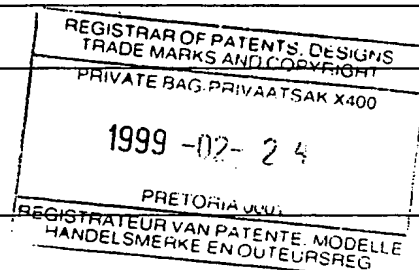
AGENT'S REFERENCE
P99/77494

FULL NAME(S) OF APPLICANT(S)

71	Potchefstroom University for Christian Higher Education
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ADDRESS(ES) OF APPLICANT(S)

1 Hoffman Street POTCHEFSTROOM



TITLE OF INVENTION

54	METHOD AND APPARATUS FOR PRODUCING OZONE
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THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2.
The earliest priority claimed is

THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO. 21 01

THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND BASED ON APPLICATION NO. 21 01

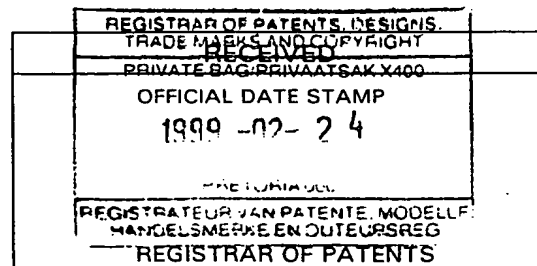
THIS APPLICATION IS ACCOMPANIED BY :

X	1	A single copy of a provisional xxxxxxx complete specification of 8 pages.	21	01
X	2	Drawings of 1 sheets.		
	3	Publication particulars and abstract (Form P.8. in duplicate).		
	4	A copy of Figure of the drawings for the abstract.		
	5	An assignment of invention.		
	6	Certified priority document(s) (State number).		
	7	Translation of priority document(s).		
	8	An assignment of priority rights.		
	9	A copy of Form P.2 and specification of S.A. Patent Application No.	21	01
	10	A declaration and power of attorney on Form P.3.		
	11	Request for ante-dating on Form P.4.		
	12	Request for classification on Form P.9.		
	13			

DATED THIS 24 th DAY OF February 19 99

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Attorneys & Notaries*

Form P.6

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978.

PROVISIONAL SPECIFICATION

(Section 30 (1) - Regulation 27)

PATENT APPLICATION NO.			LODGING DATE.		AGENT'S REFERENCE
21	01	991479	22	24-02-1999	P99/77494

FULL NAME(S) OF APPLICANT(S)	
71	Potchefstroom University for Christian Higher Education

FULL NAME(S) OF INVENTOR(S)	
72	Barend VISSER

TITLE OF INVENTION	
54	METHOD AND APPARATUS FOR PRODUCING OZONE

INTRODUCTION AND BACKGROUND TO THE INVENTION

This invention relates to a method and apparatus for producing ozone.

A known method for producing ozone includes the steps of passing oxygen at
5 1 atmosphere and 25°C through concentric metallised glass tubes to which low-
frequency power at 50-500 Hz and 10-20 kV is applied. Due to the relatively
slow change in potential (5kV per millisecond), a corona or silent electric
discharge is maintained between the electrodes. A disadvantage of this method
is that energy is lost in the form of heat, and a relatively low yield ratio of ozone
10 is achieved.

OBJECT OF THE INVENTION

15 It is accordingly an object of the present invention to provide a method and
apparatus for producing ozone with which the aforesaid disadvantage may be
overcome or at least minimised or to provide a useful alternative to the known
method.

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SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided a method of producing ozone, the method including the steps of:

- providing a housing having an inlet and an outlet;
- 5 - disposing an electrode in the housing;
- passing oxygen - containing fluid through the housing from the inlet to the outlet; and
- energising the electrode such as to cause discrete bursts of corona discharges in the housing, to produce ozone from the oxygen -
10 containing fluid.

The step of energising the electrode may include the step of generating a relative potential difference of at least 5 kV on the electrode, in less than 1 microsecond.

15

Preferably the relative potential difference of at least 5 kV on the electrode is generated in between 1 and 1000 nanoseconds.

More preferably a relative potential difference of as high as possible on the
20 electrode must be generated in as short as possible time.

The arrangement is such that discrete bursts of corona discharges are initiated

in the region of the electrode, but not maintained, due to the rapid rate at which the relative potential difference of the electrode is achieved and lost.

According to a second aspect of the invention there is provided apparatus for
5 producing ozone, the apparatus including:

- a housing having an inlet and an outlet;
- a passage for oxygen extending from the inlet to the outlet;
- an electrode disposed in the passage; and
- pulse generating means for intermittently changing the relative potential
10 difference of the electrode at a rate faster than 5 kV per microsecond.

The arrangement may be such that discrete bursts of corona discharges are initiated in the region of the electrode, without being continuously maintained.

15 The electrode may be insulated by a non-conductive layer. The layer may be resistive to corona discharge degradation.

The electrode may comprise a relatively flat metal sheet.

20 Opposite sides of the electrode may each be covered by a non-conductive layer in the form of glass sheets.

The electrode may be disposed inside a metal housing. The housing may comprise hard anodised aluminium.

5 The electrode may be spaced from the inner walls of the housing by non-conductive spacers. The spacers may be of any inert material such as ceramic or Teflon.

The pulse generating means may comprise a self – oscillating electronic circuit.

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BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described further, by way of example only, with reference to the accompanying drawings wherein:

- 15 figure 1 is a plan view of apparatus according to a preferred embodiment of the invention for producing ozone;
- figure 2 is a cross-sectional side view along lines A - A in figure 1;
- figure 3 is a cross-sectional end view along line B - B in figure 1; and
- figure 4 is a graph illustrating the energisation of an electrode of the
- 20 apparatus of figure 1.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

Referring to figures 1 to 3, apparatus according to a preferred embodiment of the invention for producing ozone, is generally designated by reference numeral 10. The apparatus 10 comprises an aluminium electrode 12 comprising a rectangular aluminium sheet having a thickness of approximately 0,1mm. The electrode 12 is insulated by two glass plates 14.1 and 14.2 of approximately 2 mm thick, which are respectively disposed on opposite sides of the electrode 12. The glass plates 14 are resistant to corona discharge degradation.

The apparatus 10 further includes a hollow housing 16 of hard anodised pure aluminium. The housing 16 is provided with an inlet 18 and an outlet 20, to which glass tubes 22.1 and 22.2 are respectively connected. A passage 24 is defined by the housing 16, the passage 24 extending between the inlet 18 and the outlet 20. The electrode 12 is disposed in the passage 24 and is spaced from the inner surfaces of the housing 16 by spacers 26 in the form of 0.6 mm Teflon discs.

The apparatus 10 further includes pulse generating means in the form of a self oscillating electronic circuit (not shown).

In use, oxygen is passed through the passage 24 over the electrode 12 and the potential difference of the electrode 12 intermittently and rapidly changed by the self oscillating circuit, at a ratio of approximately 6 kV per 10 ns. The graph shown in figure 4 represents a typical change in potential against time of the electrode 12. The effect of the rapid changes in potential is to initiate bursts of corona discharges on the outer surface of the glass sheets 14. The corona discharges are initiated without being maintained continuously. The corona discharges produce ozone from the oxygen.

Very little energy is emitted in the form of heat and the applicant has found that a relatively high yield of ozone is achieved. The applicant has further found that the yield ratio is dependant on the rate at which the relative potential difference of the electrode is changed, i.e. the faster the potential difference is changed, the more effective the apparatus 10 is able to produce ozone from oxygen.

It will be appreciated that a number of variations in detail are possible with a method and apparatus according to the invention for producing ozone, without departing from the scope and/or spirit of this disclosure.

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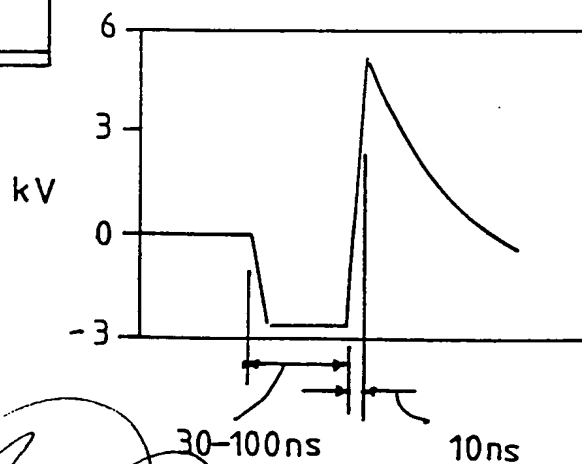
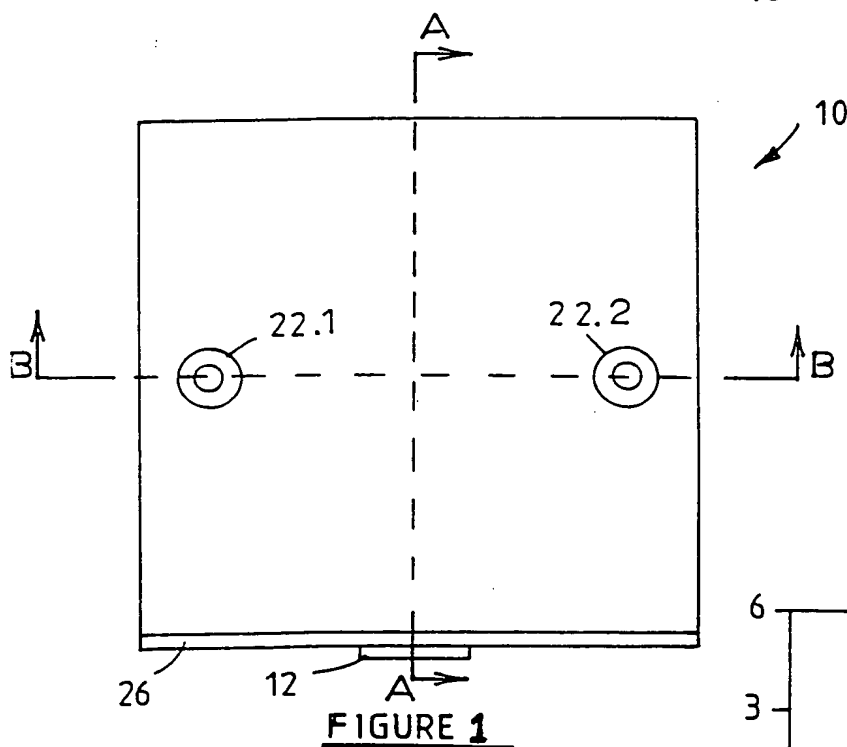
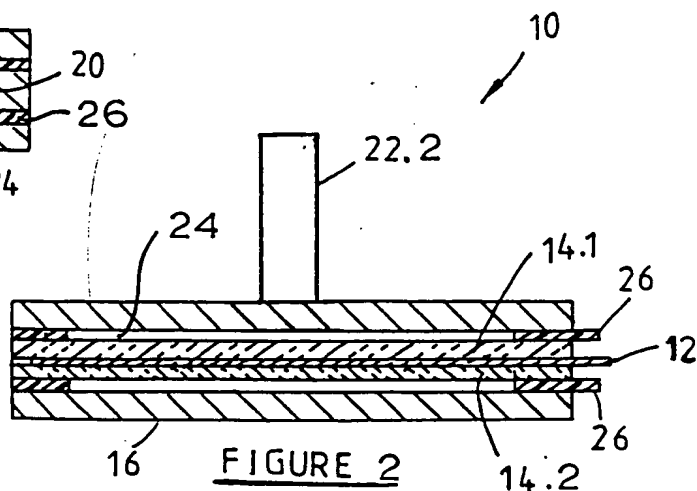
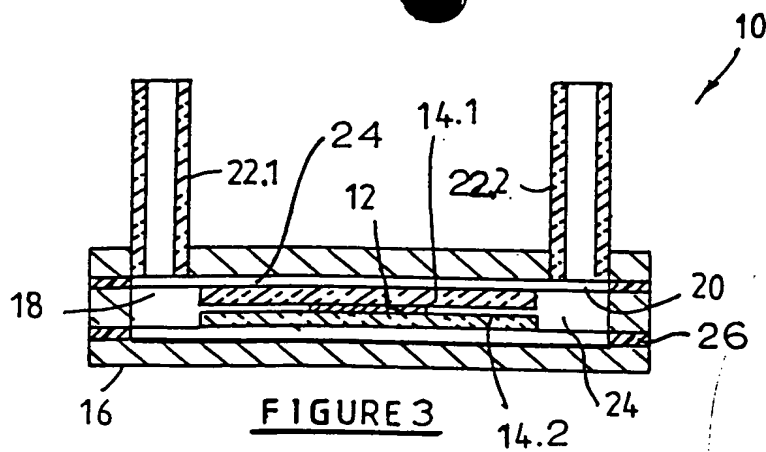
DATED THIS 24TH DAY FEBRUARY OF 1999.

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A handwritten signature in black ink, written over a horizontal line. The signature is stylized and appears to be "D. M. Kisch".

D M KISCH INC

PATENT ATTORNEYS FOR APPLICANT



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